Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

Volume XIX.
Number 3.

May, 1910.

Whole
Number 111.

THE PHILOSOPHICAL REVIEW.

SPENCER'S FORMULA OF EVOLUTION.

THE fabric of human knowledge is seemingly composed of many diverse and disparate strands. Yet, in the history of thought, we find that those whose range of ideas has traveled beyond the sphere of every-day necessities, have always, in some form or other, implicitly or explicitly, as an article of faith or a product of reason, upheld the conception of some unity behind this apparent diversity. The tendency has sometimes worked for evil, and attempts to formulate this unity have often impeded rather than assisted the advance of knowledge. Minds obsessed by false, incomplete or inadequate abstractions, are, often impervious to facts really or apparently inconsistent with their particular ideas. In spite of this, the conception commonly known as the unity of nature is one which would appear to possess much the same kind of validity that accrues to our fundamental ideas of space and time. Although it may be possible to conceive the existence of a world in which the diversity would be so complete as to defy analysis, yet we can only do so by postulating an infinite variation of particular phenomena, so that the same conditions would never recur in finite experience. Though we might argue that a being inhabiting such a sphere of existence would never acquire the idea of the unity of nature, yet by no series of arguments can we expel our own certainty of the reality of that conception. Differences and controversies arise only when we attempt to indicate in what manner it should be formulated.

We shall best be able to understand the principles of Spencer's attempt if we remember that, in his view, such a unification is only to be obtained by the same methods which have accomplished so much in the sphere of the special sciences.[1]

This view carries with it the corollary that the border line between science and philosophy is indistinct, and that the completely unified knowledge of philosophy is an ultimate ideal rather than an accomplishment of his own or of any other system. All metaphysical problems and speculations Spencer explicitly excluded from the purview of philosophy, properly so called, and, whether or no we agree with such a limitation, we must not forget to estimate his work in the light of his own object and aim.

Spencer considered that he had found some genuine clues which would aid in unravelling the complexity of all orders of phenomena. These are contained in the second part of *First Principles*, a work which has been the subject of the most extreme and diverse criticisms. One extreme is found in the little volume by Mr. Hector Macpherson, who heads his chapter dealing with this work — "The Cosmos Unveiled," while others, whom it is not necessary to mention by name, have denounced the author as a pretentious word-builder, ignorant both of science and of philosophy, whose conclusions are practically valueless. The latter view is completely answered by even the most modest estimate of the influence of Spencer's work on the special branches of knowledge with which he dealt. To what extent the former may be justified is the question with which this essay is concerned.

In the first place, it is desirable to separate one aspect of the question which is liable to be lost in the discussion of more controversial details. None at the present day can doubt that, in all orders of phenomena, there are to be found some common factors. This is one of the commonplaces of chemistry and physics. That it may be possible to formulate a more complete unification is an idea not peculiar to modern philosophy, but one which, in the light of our present knowledge, has found expression in a new form under the conception of cosmic evolution. This conception, though specially associated with Spencer's work, is greater and more fundamental than the personal doctrines of any individual however eminent. Whatever hostile critics may think of Spencer's special treatment, it is not possible to deny to him the great credit of upholding and revivifying this principle at the time when it was in danger of being forgotten in the discovery of the enormous variety of new detailed fact. More than that, it was precisely these new discoveries which Spencer found most useful in the building of his own scheme of unification.

---

[1] See *First Principles*, p. 119, and elsewhere, particularly the passage: "As each widest generalization of Science comprehends and consolidates the narrower generalizations of its own division; so the generalizations of Philosophy comprehend and consolidate the widest generalizations of Science." This and all other quotations from Spencer's work refer to the latest edition, published in 1900.

Granting the validity of the principle of universal evolution, there remains the more special question as to how far Spencer has succeeded in formulating and expressing it in a manner likely to be of present and of permanent value. One fact alone will predispose us to give this question the most careful attention. The remainder of his philosophical work was intended primarily as an application of his evolutionary ideas to all orders of phenomena. To this work it is impossible for anyone not hopelessly biased to deny very great merit. Yet *First Principles* is the coördination of the whole, and, whatever the other volumes of his philosophy may have accomplished incidentally, they were written to illustrate the applicability of his main ideas, and particularly of his famous formula of evolution, to all branches of knowledge, and particularly to those connected with life and mind.

Again, it is not possible to doubt that, in his hands, these principles have proved remarkably fertile in unravelling complexities and in solving problems presented by many diverse branches of knowledge. This is not a proof of the validity of the formula. It is possible to thread priceless pearls on worthless string; but we must not assume too hastily that the present is a case in point.

In attempting to formulate fundamental unifying principles, the philosopher who is acquainted with the trend of modern science will find part of his work already accomplished. Modern developments of chemistry and physics have elucidated two comprehensive generalizations, of which philosophy must take account, and which should be included in any attempt to unify knowledge. These, commonly known as the conservation of energy and the indestructibility of matter, are undoubtedly, so far as we can be certain of anything, of universal validity. Others again, such as the law of gravitation, while possibly not of such great theoretical certainty, are expressions of fact to which no exception has ever been discovered. The former two great principles are the starting point of Spencer's unification, yet, as usually expressed, they are not in the form that possesses the greatest philosophical value. The conservation of energy in particular is often regarded as an empirical law, which the last generation of physicists usually expressed by saying that the sum-total of kinetic and potential energy is constant, While, for the solution of certain problems of mechanics, the conception of potential energy possesses methodological value, it is out of harmony with ideas suggested from a wider point of view. From the standpoint of philosophy, potential energy is a meaningless figment, to be ranked with electric fluids, tubes of force, and other devices useful as a short cut to mathematical calculation.

To Spencer belongs the credit of first formulating a view now obtaining considerable recognition among physicists, that all energy is actual. Just as the energy of heat is not regarded as lost, but as actually existent in the motion of molecules, so gravitational energy, commonly called potential, must be regarded as actually existent in ether stresses and strains. The conception of the ether as a receptacle of energy is implicit in any theory of radiation, and generally in modern electro-magnetic theory, so present-day physicists have no logical reason for declining to accept this valuable addition to the theory of their subject which Spencer supplied so many years ago.

The philosophical form of the idea supplies one reason why Spencer adhered to his original term, the persistence of force, instead of the modern equivalent, the conservation of energy. Energy is a complex, and, as usually formulated, the latter principle requires the division into potential and kinetic to give methodological completeness. Spencer's principle, the persistence of force, includes this and much more. For physical calculation it is sometimes convenient to ignore our conceptions of force, and to deal with its effects by means of mathematical symbols. This treatment will not suffice for philosophy, which demands a more fundamental search for first principles.

This primary basis of our ideas, Spencer found in the study of psychology. He pointed out that our ideas of matter and motion are largely complexes made up from our muscular sensations of pressure and tension. That which affects our muscular sensations actively we call force; and all our conceptions, visual or tactual, are ultimately compounded from this primary element. That which affects our muscular sensations passively, we call matter; and this element of passive force (if we may use the term) or inertia, is the ineradicable element of our ideas of body. As both matter and energy are known to us in terms of force, the phrase, persistence of force, includes both the modified conception of the conservation of energy and the indestructibility of matter.[1]

Without commenting fully on this psychological analysis, it is at once clear that Spencer's principle is more fundamental than the concept of modern physics known as the conservation of energy. It is not necessary to lay any particular stress on this point, because we shall find that Spencer, in formulating his law of evolution, returns from his ultimate analysis to the more familiar ground of matter and motion.

In still another way does this conception differ from the corresponding chemical and physical principles as commonly expressed. Considered philosophically, it is not merely a valuable inductive principle, but a necessary truth of the same order as our fundamental conceptions of space and time. Although the formulation of these truths has resulted from modern physical and chemical investigations, yet it remained for Spencer to point out that they are like axioms in that proof of them is impossible.

---

[1] The exposition of the preceding paragraph indicates as nearly as I can the meaning of this part of Spencer's work which has been so grossly misunderstood. Readers of Spencer will find this clearly expressed in the paragraph commencing "While recognising this fundamental distinction . . . ," — *First Principles,* p. 172. They should also note in the same connection *Principles of Psychology,* Special Analysis, Chapters 10–18.

In every attempt at proof we are bound to include some form of the same ideas as an assumption. Though it remains to modern science to define exactly what are the permanent elements in the constitution of physical existence, to separate essential from accidental accompaniments, yet the final result, whatever it may be, is but the clearer mental presentation of ideas which are implicit in the foundation of human thought. Their negation is inconceivable. They possess that highest possible criterion of truth that, when once the relations are disentangled, and clearly represented in thought, their opposite requires the impossible assumption that something has become nothing.

This discussion supplies the best opportunity for answering another question that has often been raised concerning this principle and concerning Spencer's formula of evolution. Doubt has sometimes been expressed whether these ideas are physical or metaphysical, and, if the former, what is their relation to Spencer's particular system of metaphysics, as expressed in "The Unknowable." To the first question there is only one possible answer. The formula of evolution and the principle of the persistence of force are purely physical. Their truth or falsehood is entirely independent of Spencer's metaphysics. This statement should require small emphasis. An objective philosophy, concerned with the unification of positive knowledge, must be judged by its congruity with the facts it seeks to coördinate and explain, and cannot be dependent on metaphysical principles. That Spencer recognized and asserted this essential separation is shown by the following passage:

"The subjects on which we are about to enter (The Knowable) are independent of the subjects thus far discussed (The Unknowable) and he may reject any or all of that which has gone before while leaving himself free to accept any or all of that which is now to come. . . .

"But an account of the Transformation of Things,[1] given in the pages which follow, is simply an orderly presentation of facts; and the interpretation of the facts is nothing more than a statement of the ultimate uniformities they present — the laws to which they conform." [1]

---

[1] Professor Ward has criticised Spencer's use of capitals and, partly on this account, has attributed a metaphysical significance to his work which was not intended. The fact was that Spencer, like some other writers, used capitals for emphasis and to express the name of any unique principle. The quoted passage illustrates this peculiarity.

Owing to the subjective character of so many preceding systems of philosophy, the idea has become fixed in some academic circles that philosophy is identical with metaphysics, and the deductions, true or false, that can be drawn from metaphysical premises. In consequence, a large part of the criticism of Spencer's system has been directed to his metaphysical ideas, and many critics have assumed that when they have, to their own satisfaction, disposed of this part of his work, there is no necessity to trouble further with the philosophy. This is of course a grave error.

It is only fair to these critics to admit that, in some respects, some parts of Spencer's exposition, especially in earlier editions, give an excuse for the assumption that there is an essential connection between the two.

" Every antecedent mode of the Unknowable must have an invariable connection, quantitative and qualitative, with that mode of the Unknowable which we call its consequent." [2]

" By the Persistence of Force, we really mean the persistence of some cause which transcends our knowledge and conception. In asserting it we assert an Unconditioned Reality without beginning or end." [3]

Passages like these, and the occasional recurrence of such ideas throughout his philosophy, are liable to be misunderstood. Those who read his works without a thorough grasp of the conceptions involved, and those in search of useful controversial matter, will note these peculiarities, and, in consequence, gravely misunderstand the objects and aims of the philosophy. These are distinct flaws in an otherwise excellent exposition, which will, however, present no difficulty to those who are in sympathy with the main trend of his ideas. One great difference between the works of Spencer and those of many modern philosophers is that, while with him any such passages may be obliterated without affecting the main trend of his argument, in other cases it is difficult to disentangle the positive ideas from the mass of metaphysics with which they are involved, so that any one out of sympathy with the latter can only obtain from them detached thoughts which do not always repay the labor of the search. It is to be regretted that Spencer did not make this separation even more complete; but his explicit statement that his formula of evolution is in no way connected with his reconciliation between religion and science should make the distinction clear to all who attempt to deal critically with his philosophy.

---

[1] *First Principles*, pp. 109–10.

[2] *Ibid.*, p. 177.

[3] *Ibid.*, p. 176.

To return from this digression to the conception of universal evolution, we have already seen that the two great generalizations of modern chemistry and physics, slightly modified in form, constitute the basis of Spencer's superstructure. As the ultimate analysis of phenomena brings us down to the primary conceptions of matter and motion, both indestructible and invariable in quantity, therefore all phenomena, from this standpoint, may be regarded as modes of redistribution of matter and motion. It follows that any general principles which pervade this process of change are of supreme importance from the point of view of philosophy.

When this analysis of phenomena is definitely separated from the metaphysics with which only a minority of readers will sympathize, the charge of materialism, or any other 'ism' with a disagreeable connotation, becomes not only false but meaningless. The analysis and consequent synthesis remain purely physical, and it would be just as sensible to complain of the materialism of a text-book of mechanics. Certainly Spencer shows that his principles are applicable to inorganic and organic alike, but so are other great scientific generalizations. Spencer's formula of evolution, if valid, is but one other strand pervading all orders of phenomena. My meaning will best be illustrated by quoting the following passage from his most prominent modern opponent, Professor Ward:

"Whatever be its meaning, its purpose or its life, the cosmos in one aspect is but matter in motion. . . . The world of ideas is in some way presented through, and embodied in, the world of sense; and the sensible can be summarised in terms of matter, motion and force."[1]

It would not be difficult to raise objections to the form of this statement, but, for our present purpose, the substance is sufficient· Spencer's formula of evolution is an attempt to coördinate all orders of phenomena, in so far as they can be summarized in terms of matter, motion, and force. Such an attempt would only be invalid if such summary were impossible.

Such an expression of the conception of universal evolution, if valid, is of the greatest philosophical value. While the great generalizations of the indestructibility of matter and the conservation of energy can be described as fundamental laws of being, a true formula of evolution would be an ultimate principle of the cosmic process of becoming.

According to Spencer's formula, evolution in its primary aspect, consists of "an integration of matter and concomitant dissipation of motion." The contrary process, dissolution, is similarly "an absorption of motion and concomitant dissipation of matter." In examining this primary aspect of the formula, it is first of all necessary to assure ourselves that integration of matter and dissipation of motion are necessary concomitants. On this matter Spencer remarks:

"These are truisms. Constituent parts cannot aggregate without losing some of their relative motion; and they cannot separate without more relative motion being given to them. We are not concerned with any motion which the components of a mass may have with respect to other masses, we are concerned only with the motion they have with respect to one another. Confining our attention to this internal motion and to the matter possessing it, the axiom that we have to recognize is that a progressing consolidation involves a decrease of internal motion, and that increase of internal motion involves a progressing unconsolidation."[2]

---

[1] *Naturalism and Agnosticism*, Vol. I, pp. 247–8; quotations refer to the 3d English edition (1906).

[2] Cf. the passage: — "But, though every change furthers one or other of these

While evolution and dissolution, understood in this sense, are opposite processes, and as a whole every aggregate is undergoing one or the other, yet speaking more precisely, both are everywhere concurrent, and the observed effect is the resultant of the two.[1]

The truth of this principle can hardly be questioned, yet, simple as it appears at first sight, it has sometimes been misunderstood, and may possibly require some slight qualification. The following extract, taken from a well-known work on the concepts of science, shows the kind of errors that are likely to arise if Spencer's formula be regarded apart from those physical principles from which it has been deduced.

" According to Spencer where there is increase of motion there is decreasing aggregation of matter. Yet we have only to drop a weight to see increase of motion accompanying increased aggregation of matter, namely earth and weight approaching each other." [2]

The misunderstanding contained in this passage, though excusable in that it is directed to an allotropic and somewhat more ambiguous form of this principle which is contained in one of Spencer's essays, is one that any careful student of his work will have no difficulty in unraveling. To those who have followed this exposition, the reply will be simple. Matter is undoubtedly integrated (aggregated), and as a moment's consideration will show us, the motion is dissipated (not increased). In the first place bound in ether strains, distributed between the mass and each ponderable particle of the attracting earth, it changes first to kinetic motion, then to heat which is radiated into infinite space.

---

processes, neither process is ever unqualified by the other. For each aggregate is at all times both gaining motion and losing motion. Every mass from a grain of sand to a planet, radiates heat to other masses, and absorbs heat radiated by other masses, and in so far as it does the one it becomes integrated, while in so far as it does the other it becomes disintegrated. . . . Here, as elsewhere, the integration or the disintegration is a differential result" (*First Principles*, p. 259).

[1] *First Principles*, p. 257.

[2] *Grammar of Science*, 2d edition (1899) by Professor Karl Pearson, pp. 512–3. It is strange that Professor Pearson did not appear to recognize that the principle he criticises is the same as Spencer's formula of evolution and that he did not grasp its meaning. Whatever the reason may be, however, the error is not Spencer's but Professor Pearson's.

At the same time, it is true that, unless explained more fully, it can only be considered as absolutely valid if stated cosmically and in general terms. At times, applying the ordinary meaning to the terms 'integration' and 'dissipation,' particular conditions, and specially chemical changes, will mask the main process. An explosion, for instance, while it implies dissipation of matter, is also accompanied by dissipation of motion. Many other instances could be given, including those so ably marshalled, in another connection, by Spencer himself.[1]

It would be impossible, in the brief space at my disposal, for me to attempt to unravel all these special tangles, and to follow all these instances to their logical conclusions, in order to show that they are not at variance with so obvious a principle as the first part of Spencer's formula. To this subject I hope to return again at a later date. For present purposes, it is only possible to point out that, regarded cosmically, there can be no possible doubt of the truth of this principle, and to express the opinion that these apparent exceptions no more invalidate its truth than the simple fact that the waters of the river flow to the sea is falsified because the river winds, and here and there there are eddies in the stream.

Although this aspect of Spencer's formula of evolution is primary, it is the secondary aspects that are of greater interest. If the aggregates are small and the process rapid, no other changes can take place which can be described in general terms.[2] If the masses are large or the process slow, then we find the remarkable and interesting changes, the description of which forms so prominent a part of Spencer's work.

---

[1] *First Principles*, pp. 269, etc.

[2] This part of the exposition (see *First Principles*, p. 262) was one on which Spencer laid some stress. Professor Ward has attempted to answer the argument by referring to fermentation and enzyme action (*Naturalism and Agnosticism*, appendix to volume I, p. 326), but, by so doing, he has only shown that he is not a good critic of the treatment of physical principles. In the first place most of the examples (fermentation) he mentions are not purely chemical but distinctly organic, secondly these very reactions are, as every chemist knows, specially complex. The products of (*e. g.*) yeast fermentation of sugar are exceedingly numerous and they really illustrate very well the increase of complexity which accompanies slowness of reaction. Also, it should be remarked, there is a distinction between the rapidity of the reaction as a whole and that of the change in any particular chemical molecule. Chemical reactions, to be included in an evolutionary formula, must be described not as molar but as molecular. Spencer's formula of evolution is certainly not disproved or discredited by any of the Wardian criticisms.

These special conditions, the existence of masses of considerable size and of a comparatively slow process of change, are always satisfied in the phenomena with which we commonly associate the term evolution. Alike in the slowly cooling and aggregating nebula, the developing organism, and in those still more involved complexes found in the institutions of human society, the slowly changing masses are subject to and affected by an infinite variety of incident forces. The last example will not be convincing to those unfamiliar with these conceptions, but Spencer has shown by a wealth of illustration that the same conditions apply, and that human societies, under the aspect of matter in motion, can be described in the same terms.

The main changes occasioned by the secondary redistribution of slowly evolving matter are described by Spencer as increase in the qualities of definiteness, coherence and heterogeneity, so that this involved analysis leads to the famous formula of evolution, which has been so often quoted and so widely discussed.

" Evolution is an integration of matter and concomitant dissipation of motion; during which the matter passes from an indefinite, incoherent homogeneity to a definite, coherent heterogeneity, and during which the retained motion undergoes a parallel transformation." [1]

Concerning this formula the intelligent critic will naturally be inclined to ask three pertinent questions: — What does it mean? Is it true? If true what is its practical value and validity? How far and within what limits does it give us a clue which will help us to unravel some of the complexities of natural phenomena?

The first of these is not easy to answer in a few words. It is impossible here to give any idea of the manner in which Spencer leads step by step to this generalization. The fertility of the argument, the wealth of illustration drawn from every order of phenomena, defy condensation. The terms are of the highest degree of abstractness, as indeed any such formula is bound to be, and, to those who have not given to Spencer's work very careful study, it cannot help but be difficult to understand. It will best serve the purpose of this exposition to give a single illustration, and from that I hope it may be possible for those who are not able to spare the time thoroughly to study the original to gain some slight idea of the meaning and range of the conception.

---

[1] *Op. cit.*, p. 367. I omit the new addition "relatively," as the latter was only added to prevent misunderstandings which ought never to have arisen. Readers of this exposition will not need to be informed that this is a description of a process of change, and that it is not necessarily implied that evolving matter is ever absolutely homogeneous, absolutely indefinite, or absolutely incoherent, if indeed these terms have any meaning.

We are most of us acquainted with the nebular hypothesis, which indeed is now a necessary integral part of any rational present day astronomy.[1] How a nebula originates need not now concern us; it is sufficient for our purpose that, as a matter of fact, there exist in various parts of the heavens many irregular shaped bodies of very low density, which, spectroscopic analysis informs us, are masses of glowing gas. This is the first stage in stellar evolution. This mass (note the Spencerian formula) is indefinite in outline, incoherent in substance (as a gaseous body must be), and comparatively homogeneous in content. The substance is gaseous, the lines of its spectrum are comparatively few, showing the presence of only a small number of chemical elements, while our knowledge of gaseous masses precludes the possibility of any considerable differentiation between its constituent parts. Thus the nebula is an excellent example of the first stage in the evolution of an aggregate.

Evolution of this nebula proceeds by "integration of matter and dissipation of motion." As the mass slowly cools the energy, whether of molar motion, position,[2] or heat, radiates into space. The motion is dissipated.[3] The matter integrates; the particles gravitate closer together, and, in course of ages, in place of what was a nebulous mass, there gradually appears a stellar system.

---

[1] It must be remembered that Professor Chamberlin's planetismoid theory is also a nebular hypothesis, inferring that the solar system is derived from a spiral nebula. It is at once the strength and the weakness of Spencer's formula that it is equally applicable to either alternative.

[2] For convenience of exposition, I use the idea of potential energy.

[3] This "dissipation of motion" is a plain statement of fact, and has, of course, no connection with that controversial deduction from the second law of thermodynamics — the dissipation of energy.

These masses are enormous in size, and consequently evolution is slow, secondary redistributions of matter and motion occur. The outline becomes more definite (this needs no explanation). The mass or masses become more coherent (liquid or solid bodies take the place of the gaseous nebula). The matter becomes heterogeneous: — heterogeneous in content (many chemical elements and ultimately an infinite variety of compounds take the place of a few gaseous elements); heterogeneous in structure (instead of a gaseous structureless mass there is found a star, with photosphere, and chromosphere and a group of planets of still greater complexity, revolving at different distances and with different speeds);[1] heterogeneous in other ways. The retained motion becomes more definite, coherent, and heterogeneous — this I think can be accepted without detailed explanation.[2]

Is it true? Is it a correct description of natural processes in all orders of phenomena? Whatever answer the present day thinker may be inclined to give, there can be no doubt that the inductive verification contained in the whole of Spencer's philosophy is overwhelming. We have just seen how exactly this formula fits the facts in the great cosmic example of solar and planetary evolution. This is but one of many instances that can be given of the manner in which, considered as a descriptive formula, it is verified by an examination of the facts of inorganic nature, of living organisms, and of the still more complex groupings exhibited by social life and institutions. From the inductive standpoint, this principle, for more than forty years, has been subjected to the criticism of thinkers of every school of thought, and has stood the test of time. Hostile criticism (and this has not been lacking) has been directed less to the accuracy of the formula as a description of fact than to the details of the process of reasoning by which Spencer deduces his formula from more fundamental principles.

---

[1] Professor James Ward (*Naturalism and Agnosticism* (3d edition), Vol. I, 230) objects to the application of the term heterogeneous to planetary orbits, but this is a somewhat foolish quibble about words. In the first place the paths of the planets are diverse, and secondly the planets do not move in any exact geometrical figure. The 'ellipses' are merely convenient mathematical *approximations*.

[2] Cf. *First Principles*, pp. 281, 302, 336.

This latter deductive treatment is much too complicated to make it possible for me to enter upon the discussion in a short essay. The last few chapters of *First Principles* consist of an attempt to show that the formula of evolution is a necessary consequence of the persistence of force: "To this an ultimate analysis[1] brings us down, and on this a rational synthesis must build up." To those interested in this interpretation of evolution, these few chapters[2] will supply an example of close and careful reasoning which well deserves study and attention. Whether this reasoning can be maintained in its entirety is a question on which I shall be excused from expressing a decided opinion where I am unable to make any attempt at an adequate exposition or discussion. While I am convinced that, in the main, the reasoning is sound, I do not now commit myself either to agreement or disagreement with the details of the argument. Whatever our opinion may be on this matter, there can be little doubt that the inductive verification is complete enough to warrant our assuming its truth provisionally and proceeding to the question of its practical value and validity.

It is from this standpoint that Spencer's principle is open to the most cogent criticisms, and at this point that a number of speculative problems arise. For the purposes of this discussion it will be convenient to compare Spencer's formula with the three physical principles which are generally admitted to be of universal applicability — the law of gravitation, the indestructibility of matter, and the conservation of energy. All these have one feature in common which makes them in that respect of greater practical value than Spencer's principle. They are quantitative while the other is but qualitative, and so, while in simple cases it is possible to make specific deductions from these, nothing of the kind has ever been accomplished with the aid of the formula of evolution. Let us imagine a law of gravitation, robbed of its quantitative element, to read: "Every particle of matter attracts every other particle of matter." Such a principle would be true, but much of its practical value would have disappeared. Without going all the way to the pragmatist position, we must at least admit that a law, from which no practical deductions can be made, is one which we can only note and put on the shelf till it is possible to make use of it. There are, however, two considerations which should not be overlooked in assessing its value. A qualitative proposition may be a necessary stepping stone to a fuller and quantitative statement of the truth it contains; and again, because no practical deductions have been made from a universal principle, it does not therefore follow that valuable deductions may not be discovered in the future.

---

[1] *Op. cit.*, p. 369. In view of a remark in Professor Ward's *Naturalism and Agnosticism* that "Spencer confuses analysis with abstraction," it is as well to mention that the term analysis does not imply that in phenomena there are no other aspects than the 'Persistence of Force.' The word must not be interpreted in too chemical a sense. In short, like any other work, Spencer's philosophy requires to be read with some common sense and some regard to the context.

[2] Chapters 18–22 of *First Principles*.

Even if we apply the pragmatist test in its crudest form, Spencer's principle will not be found to have been entirely barren, and it finds special interest in the fact that its applicability is greatest in precisely those branches of knowledge where the other great physical principles are so entangled with other factors that they afford us very little help in unravelling the complexity. Readers, for example, of Professor Sully's work on psychology [1] (to say nothing of Spencer's own works) cannot but admit that, even in psychology, Spencer's principles of differentiation and integration are of some value. In biology and in sociology Spencer has pointed out examples too numerous to mention. Again, in speculation on the largest aspects of the cosmic process of change, it is not a small thing to possess even one conception which pervades all nature.

Like every other great principle, it will serve us well so long as we do not expect too much of it. A law of the highest degree of abstractness will not by itself give particular conclusions, it only provides a clue to the main trend of natural processes. Although it provides us with a description of the all-pervading process of evolution and of dissolution, it does not tell us when, in the cosmic rhythm, the one or the other will predominate. Dissolution replaces evolution when the quantity of motion received is greater than the quantity dissipated, but precisely when the one process will replace the other is decided by incalculable particular conditions. When the impossibility of obtaining particular conclusions from his formula was brought to Spencer's notice, he pertinently remarked that even that exact quantitative principle — the law of gravitation — would not, by any known mathematical process, give exact results even in the simple case of three gravitating bodies, while, in a globular star cluster, it would be impossible to disentangle the complexity. From a principle so abstract as Spencer's formula only general conclusions can be expected, but even these are not without their value. And, even apart from particular deductions, there is to many minds a supreme interest in discovering a general truth, an interest which is not easy to explain to those who have it not, but which will be understood by those who value knowledge for its own sake.

---

[1] *The Human Mind*, by Prof. James Sully, particularly chapter 7.

To take this comparatively modest view of the value of Spencer's formula is but to class it with all other great fundamental principles, and, though Spencer attached to it greater importance than probably anyone at the present time is likely to do, he was well aware of its necessary limitations. When we realize the true nature of these evolutionary principles, when we see clearly that from the nature of the case they cannot solve all problems, we can understand the real value of this admirable, and, within reasonable limits, successful attempt to unify knowledge by showing one more common strand pervading all orders of phenomena.

Those who specialize in physical science have not yet realized the range of Spencer's conceptions so far as they can be applied to that side of human knowledge. The terminology of *First Principles*, as of all Spencer's work, differs from that of the special sciences. This is as it must be, the terminology of the particular sciences have reference only to the facts to be found in a certain narrow sphere, that of an objective philosophy refers to all knowledge. Readers of Spencer's work, who are particularly conversant with physics, will find much that will vitalize and illuminate their own work, especially in its most general aspects. In the sphere of physical science, Spencer's general ideas have never been developed to particular conclusions, but, if they had been, it is not unlikely that their effect might have been as great as in the life sciences. Apart from the principle of the actuality of all energy, which I have touched lightly, and the formula of evolution, which I have discussed at greater length, *First Principles* alone contains not a few ideas applicable to physical science. The two chapters on the "Rhythm of Motion" and "Segregration" will be found to contain thought and principles which throw some light on physical processes as yet obscure, at any rate to the extent of showing that they are particular cases of more general laws.

Those who watch the progress of chemical and physical science will note with interest the manner in which present-day developments are breaking down, one by one, the barriers which seemed to render the conception of universal evolution, of which Spencer has been the most noted exponent, more a subject for remote speculation than for present day philosophy. To the experimental genius of Sir William Ramsay and others, the seemingly impenetrable barrier presented by the chemical elements has already begun to yield. When previously we could only speculate or infer, now we know that at least some of these are elements only in the sense that their disintegration involves an energy change of a different order from that accompanying the decomposition of other substances. In the most general aspect of Spencer's ideas, the unity of all matter as of all nature, the main trend of modern thought and research confirms this fundamental principle, and, if for that alone, the most modest estimate of a work which so clearly formulated the principle of universal evolution cannot deny to it very great and permanent value.

H. S. SHELTON.